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# Towards a Joint Action Plan for Research and Development in the Offshore Wind Service Industry

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## Abstract

This paper presents a joint action plan (JAP) for research and development and innovation (RDI) in the offshore wind service industry in Denmark, Germany, Norway and the UK. Offshore wind servicing (OWS) is in this context defined as both assembly and installation of offshore wind farms as well as their operation and maintenance during their lifetime. Earlier studies have indicated that over the life cycle of an offshore farm the cost of OWS can be up to 46% of the life cycle cost of the farm including up-front investment and installation. Furthermore, the North Sea is currently the most important site for offshore wind installations, and industry clusters based on OWS are emerging in regions around the North Sea.

The JAP builds on a mapping (based on desk studies, patent analyses, and bibliometrics) of each of participating region's existing capabilities, and on an overall strategic orientation and options for a innovation. The JAP is built on this foundation together with stakeholders from the four regions, comprising representatives from R&D and education, policy makers and offshore wind industry. Following the workshop, the ECOWindS consortium has been developing the proposed action plan further based on consultations with the stakeholders of the industry.

## Introduction

As Europe is working its way towards a low carbon future as laid out in the European Strategic Energy Technology Plan (European Commission, 2007), the importance of renewable energy sources is growing. Particularly there are high expectations to the role of offshore wind, and the installed capacity is projected to increase significantly towards 2020 and beyond (Corbetta, 2014; IRENA Secretariat, 2012). However, offshore wind energy is relatively expensive as measured by Levelized Cost of Energy (LCoE), and thus the industry has outlined an ambitious goal of reducing the cost of offshore wind by 40% from today's average LCoE by 2020.

While capital expenditure to major components and other up-front costs play a major role in LCoE, the services for project development installation, operation and maintenance (O&M) contribute up to 46% of LCoE (capital and operating expenditure). O&M services' contribution alone is estimated between 25 and 28% (Azau & Casey, 2011; Green & Vasilakos, 2011; Stolpe et al., 2014). By these numbers, it is relatively clear that while much attention is rightly paid to development of the physical components for offshore wind farms and the associated technologies, the services associated with offshore wind farms hold potential for cost reduction as well.

The objective of the paper is to present the result of the development of an international, cross-regional, agenda for research, development and innovation specifically for Offshore Wind Services. The work presented is a part of the ongoing project European Clusters for Offshore Wind Servicing (ECOWindS). The aim of the JAP is to establish a trans-national plan of action for supporting the development of Offshore Wind Service (OWS) industry through measures of Research, Development and Innovation (RDI). The JAP is an agenda for collaboration aimed to develop new and improved OWS business models, technologies and other concepts in support of general offshore wind cost reduction targets and OWS- specific goals (figure 1). The JAP is a complement to other research agendas on wind power presented or under development by other organizations by approaching the challenges of offshore wind from the service perspective (e.g. Arwas et al., 2012; EERA, 2014; Megavind, 2013; TPWind, 2014).

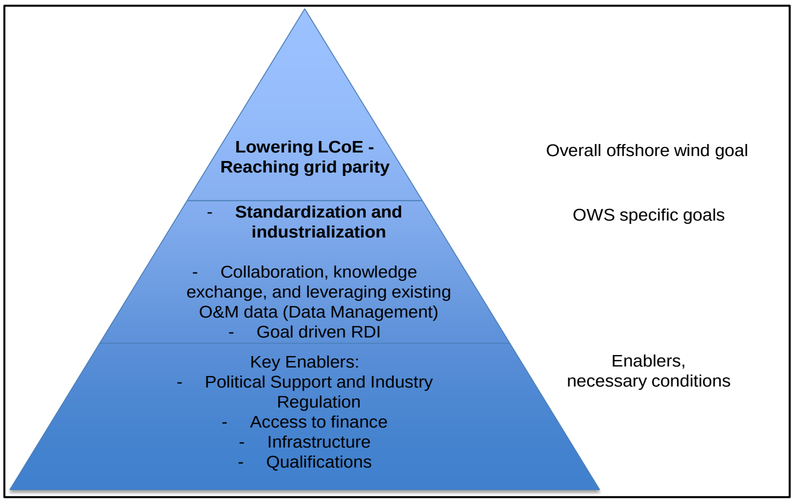


*Figure 1 Hierarchy of goals for the OWS industry*

The ECOWindS project is funded by the European REGIONS program: Transnational cooperation between regional research-driven clusters, a part of FP7. ECOWindS is a collaboration between research-driven clusters within offshore wind servicing in four regions around the North Sea. The partner regions were: South Denmark (Southern Jutland), East of England (East Anglia), North West Germany (Bremen-Bremerhaven region, federal states [Bundesländer] of Bremen, Hamburg, and Niedersachsen, and as an extended region Schleswig-Holstein, Mecklenburg-Vorpommern and Nordrhein-Westfalen as well) and Møre in West Norway.

The rest of the paper is organized as follows. The second section defines what do we mean by 'Offshore Winds Service' industry. The third section describes the process and methods for building the Joint Action Plan. The fourth section provides an overview to the Joint Action plan. Finally, the fifth section closes the paper with conclusions.

## The Offshore Wind Servicing Sector

In this paper the offshore wind servicing (OWS) is defined as the assembly through to maintenance stages of wind farm activity. This is summarised in the below diagrams. As a result the project will not be looking at areas like manufacturing in detail but the outcomes may have a future effect on these elements.

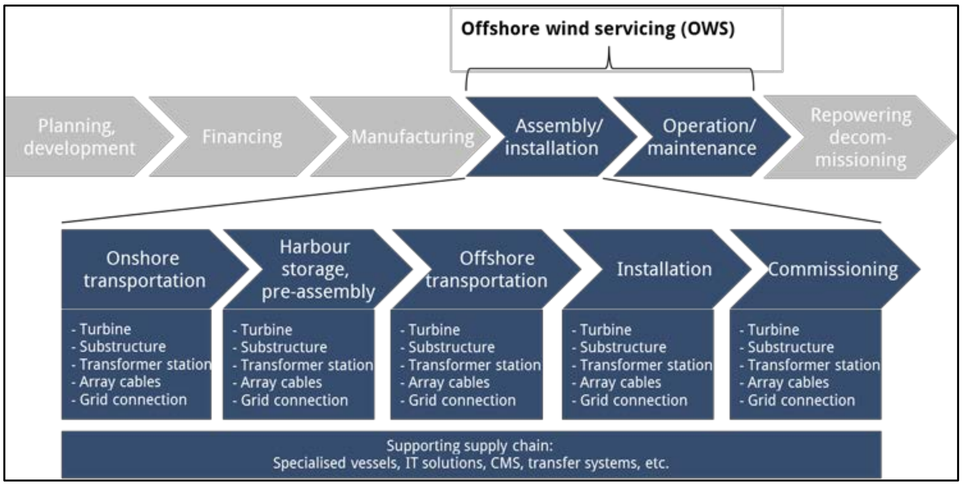


*Figure 2  Detailed breakdown of Assembly and Installation.*

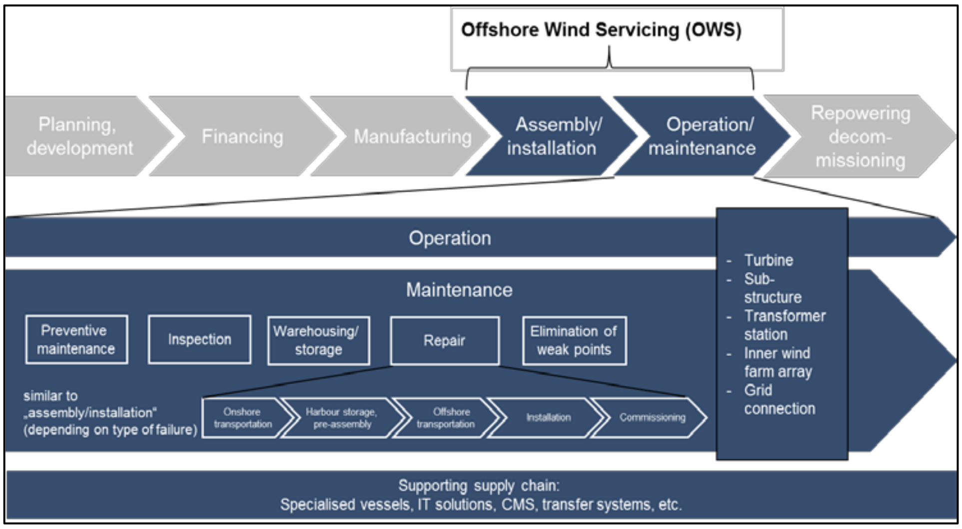


*Figure 3 Detailed breakdown of Operations and Maintenance.*

OWS lays in the intersection of wind energy, wind-relevant O&M, building and offshore service industries. The offshore industry refers in common use to offshore oil & gas industry, which is clearly adjacent and analogous, but may in the short term actually compete with offshore wind for OWS resources.

The OWS industry is still in its infancy or the phase of emergence in most countries. The development of the industry is driven by the push for more renewable capacity in general, which then generates a pull for OWS. While the OWS as an industry is merging, its roots and analogies or substitutes can be found in the following relevant branches: Offshore industry; offshore marine service industry and offshore support vessels, including crane vessels, anchor handling towing and supply vessels, jack-up barges and platform/multi-purpose support vessels; electro-mechanical installations, operations & maintenance service industry; as well as civil engineering, marine construction, cable laying.

**Method – the process leading to the Joint Action Plan**

Theoretically, the EcoWindS project – and the paper - draws on the concept of Regional Smart Specialization, which aims to support the European Cohesion target by enabling regions to identify their relative strengths and leverage them, while avoiding imitation or duplication and head-on competition with other regions (Foray et al., 2012).

Methodologically, the joint action plan builds on other parts of the ECOWindS project. Most notably it builds on a mapping (based on desk studies, patent analyses, and bibliometrics) of each of participating regions existing capabilities, and on an overall strategic orientation and options for an innovation and research strategy (based on stakeholder workshops in the four regions). The following figure illustrates the flow of information between the deliverables.

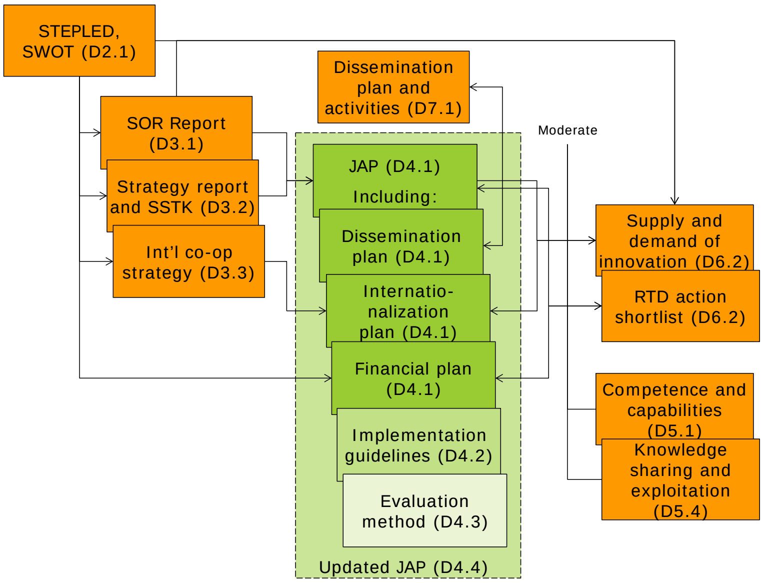


*Figure 4. Logical flow between ECOwindS deliverables (DX.x, where X is the work package no. and x is the running no. within the work package)*

The following figure presents an overview of the on-going JAP process (Figure 5). The foundation for the JAP was established through a workshop with stakeholders from the four regions, comprising representatives from R&D and education, policy makers and offshore wind industry. The workshop took place March 10th 2014 at the EWEA Annual Event in Barcelona. Altogether 31 participants, from the four regions were present at the workshop, comprising representatives from organisations for R&D and education, policy makers and offshore wind industry.

The key objectives for the workshop were to present the results from ECOWindS Regional Mapping (WP2) and Strategy (WP3) Work Packages and to develop actions for the future of the Offshore Wind Service (OWS) industry. DTU designed a collaborative roadmapping process and facilitated the group through the agenda (for details of the workshop, c.f. Piirainen, 2014).

The workshop started with presentation about the key findings of the Regional Mapping and proceeded to the Strategic Orientation to set the framework for the actions for the future. Building on the orientation presentations, the group was led to a collaborative roadmapping process. During the roadmapping phase, the group discussed key goals for the next 3-8 years in the OWS industry, prioritised them, and continued on to generate ideas for concrete actions to advance towards the goals. Then these ideas for actions were clustered and prioritised. The final stage in the workshop was a session for drafting roadmaps for OWS.

The participants of the JAP workshop contributed altogether 97 initial ideas for actions to develop OWS through Research & Development & Innovation (RDI). The initial ideas were clustered to 17 main actions, prioritized by the participants and organized to a timeline as an initial roadmap for the OWS industry. The contributions from the workshop are documented in ECOWindS Joint Action Plan.

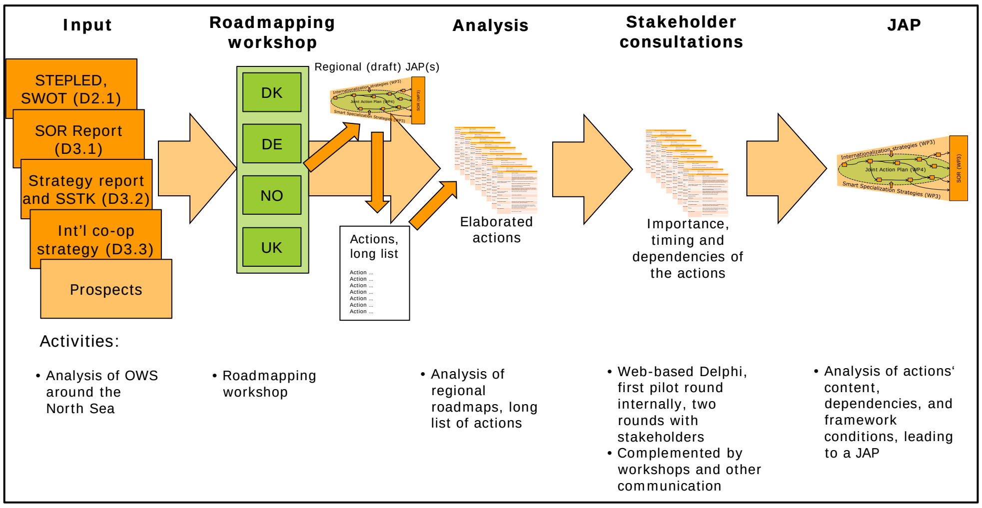


*Figure 5. Overview of the process.*

The process after the workshop has concentrated on following up on and refining the stakeholders' ideas and synchronising them with other ECOWindS findings. The JAP actions were discussed and developed in a working meeting with the partners in September 2014, in Copenhagen. The meeting brought the partners' joint expertise together and synchronised between the parallel work packages. This work contributed to the JAP and the Guidelines for implementation, which are available from the ECOWindS project website ("ECOWindS: The European Clusters for Offshore Wind Servicing," 2013). At the time of the writing, the ECOWindS consortium is conducting further stakeholder consultations on the actions, contributing towards the final Joint Action plan, to be published late autumn 2015.

### Overview to the actions

The joint action plan consists of 8 proposed actions, which can be divided into four parallel work streams which support each other. The following table presents an overview to the actions in terms of purpose and rationale (Table 1). The action themselves can be viewed as projects or programmes that make up a portfolio of OWS development.

### Flow of actions and timeline

The central storyline of the JAP is that through development of inter-regional interconnections, the OWS enterprises gain complementary capabilities (Piirainen, Tanner, Alkærsig, & Andersen, 2014) and are able to deliver new and improved services for the operators. Networking creates closer business relations enables quicker and more candid feedback within the whole offshore wind ecosystem that enables standardization of components, processes and practices, which lays foundations for the continuous improvement of the OWS service delivery.

*Table 1 Overview of the actions.*

| No. | Action | Purpose | Rationale |
|---|---|---|---|
| 1 | Establish a long lasting joint initiative for knowledge sharing and innovation between regions | The purpose of this activity is to support OWS specific collaboration and to complement the existing collaboration efforts by focusing on international and cross regional collaboration by bridging existing regional platforms to enable new business collaboration across regional and cluster borders. | The OWS industry is early in development and still fragmented. Grasping the collaboration opportunities and leveraging the complementary assets between industry constituents are needed to realize the value of OWS. |
| 2 | Develop a value proposition for OWS as an industry in itself | Stakeholders need to understand the value created specifically by OWS within the framework of offshore wind. Today the OWS value chain is fragmented as the actors identify with different industries. Recognising OWS as an industry enables capturing synergies and consolidation over old industry boundaries. | Improve communication within and outside OW/-S industry by developing a clear brand message for OWS tailored for various stakeholders for OWS and establishing a communication platform for delivering the message. |
| 3 | Develop OWS specific mission-oriented research, development and innovation program | There is a need for R&D to lower the cost of offshore wind energy. Common agreement over the specific industry goals and finding mutual interests and collaboration opportunities leading up to cost reduction in OWS Increased knowledge, new technology and new business opportunities are needed | Develop a problem driven and *OWS specific* international research program with clear priorities and a focus on generic large scale technologies which are important for OWS and are not featured on existing research agendas.. |
| 4 | Drive for international OWS specific standards | Standards enable incremental cost reductions in OWS value chain and offer the possibility to drive for economies of scale in manufacturing and O&M through industry standards. The long-term result is less complexity in wind farm planning, installation and maintenance. | Provide a platform for technical standardization and drive emerging industry standards towards official status in key areas, building on the short term actions and building relations towards the future. |
| 5 | Develop OWS specific skills and training programs across regions | OWS specific training programs and qualifications contribute to availability of skilled and qualified workers for the demanding OWS tasks and improves labour mobility. Better labour mobility enables flexible OWS, lessens local labour shortages and leads to incremental gains in O&M cost. | Harmonize skills and Occupational Health and Safety requirements and certifications for OWS across EU. Develop EU-wide economically and socially sustainable common qualifications and certifications for OWS workers to complement the existing GWO standards. Develop matching international training programs. |
| 6 | Develop an OWS Industry Database | Development of new business across the regions and optimization of existing services through collaboration need comprehensive solutions for information exchange. A comprehensive one-stop-shop industry database/portal specifically for OWS is needed | Support development of OWS services and the emergence of international networks by aggregating relevant knowledge |
| 7 | Establish OWS Specific Test Sites and Research Infrastructure | Increased experience and knowledge about reliability and maintenance need of new technologies; development and testing of new installation and O&M procedures and technologies; develop and test wind farm concepts – leading up to lower life-cycle cost in large scale installations Innovation leading to lower lice-cycle cost/LCoE. | Build international offshore test sites for new offshore specific technologies, using existing infrastructures onshore and offshore where appropriate. |
| 8 | Drive regulatory harmonization on Occupational Health & Safety | Harmonization of regulation on OH&S improves mobility of skilled workers and allows flexibility for OWS without endangering personnel or equipment. Better labour mobility enables flexible OWS, lessens local labour shortages and leads to incremental gains in O&M cost | Develop EU-wide common qualifications and certifications for OWS workers across jurisdictions |

Following this logical framework, the first work stream of proposed actions include three ‘coordination’ actions that build the necessary networks and social capital that is needed to achieve the major actions. The first action is setting up a knowledge sharing initiative between the clusters. Lack of communication and coordination is a recognised challenge within the offshore wind value chain, and creates resource congestion and cause bottle necks for delivery of solutions and services (Stolpe et al., 2014). The initiative is driven by the industry associations, first by the ECOWindS partners and later a Post-ECOWindS consortium comprising major European Offshore Wind and OWS industry associations and cluster management organisations. Setting up concrete networking activities locally and building international linkages enables networking within the industry, which contributes to building future RDI and business ventures. The second proposed action (Action 2) to be undertaken concurrently with the first, is outlining a clear value proposition and message for the OWS industry as an industry in itself. OWS as an emerging industry is to a degree overshadowed by or lost within offshore wind.

The third action (Action 3) is setting up a mission-oriented and OWS-specific RDI program. The added value of the program is to complement the existing programs and roadmaps reviewed above by consolidating OWS specific topics to one program that has similar credibility as EERA, TPWind or MegaVind (EERA, 2014; Megavind, 2013; TPWind, 2014). The action proposes several alternative topics based on stakeholders' expressed interest. The key in this action is to leverage the knowledge sharing platform to build serious consortia around the topics and continue to building projects and proposals around the stakeholders' interests. The action is driven by a post-ECOWindS consortium with stakeholders.

Additional fourth coordination action is building an OWS database and portal (Action 6) supports communication and RDI. The aim of the database is to provide a one stop shop for information that enables benchmarking reliability and service efficiency and optimizing services across farms relevant specifically for OWS stakeholders.

Building on the foundation of coordination the second work stream is 'Research, Development and Innovation (RDI)'. The core of this stream is a research program of OWS specific research topics that complement the existing RDI that goes on in wind power and offshore wind. The key underlying theme in OWS specific RDI is development of interfaces between the components of a wind farm and the service equipment. The aim is to achieve a degree of standardisation that enables effective installation and O&M of offshore farms, while not being stifling to innovation in key technical areas that add value to power generation.

The work in this stream build directly on the RDI program set with the stakeholders as the action (Action 3) unfolds. The program is highly synergistic with the harmonisation actions (below) as joining forces in RDI open the door to develop effective industry standards that pave the way for official standardization. Certain key themes for RDI have been raised by the the stakeholders. From a technical OWS perspective, the installation cost within the given conditions depends on the ease of installation of the components, their compatibility with each other, and the installation equipment. Similarly, the effectiveness of the O&M services depend on interoperability and compatibility between service equipment and vessels with wind farm components. The OWS specific aspect is development of robust procedures for installation, operation and maintenance, to increase availability of service, effectiveness and independence from the weather conditions.

A related core action in the mid-term is establishing OWS specific test sites and other research infrastructures (Action 7). Present test sites are very focused on improving reliability and performance of turbines alone or as farms. However, the exiting sites do not enable testing core OWS technologies and procedures that are related to installation and O&M procedures, and secondarily on foundations, grids, transformers and turbines insofar that these major components impose demands on the OWS procedures.

The third work stream is 'harmonization and standardization'. The core action is drive for OWS specific technical standards (Action 4) together with key OEMs. There are serious on-going efforts for standardization, not the least the IEC TC88 on wind turbines and components (IEC, 2014). The objective of this action is to complement, provide added drive and introduce OWS specific topics and viewpoints to existing standards committees and processes, and secondarily set up new standards initiatives within existing frameworks as needed.

The harmonisation work stream intersects with skills (see below) in the proposed long-term action to contribute to harmonisation of formal and informal qualifications and training certificates needed to work on OWS across the ECOWindS regions and beyond (Action 8). The aim is to propose harmonisation between national occupational health and safety (OH&S) guidelines, to find an acceptable level of protection and harmonised certificates for OWS. The work is parallel to Global Wind Organization (GWO) OH&S work and compliments it for offshore specifically. An additional topic is harmonising health, safety, environmental and quality (HSEQ) policies together with the training certificates to enable efficient resource use. .

The fourth work stream is ‘skills and qualifications’ that relates strongly to harmonisation action on skills and training (Action 8). The aim of the sill work stream is to ensure that there is a skilled and qualified workforce to ensure efficient operation of offshore farms and by extension reliable delivery of power. Offshore wind capacity is projected to grow tremendously, which means that OWS capacity has to grow proportionally. However, the existing OWS resources are already employed close to capacity.

The main action proposal is to develop OWS specific training programs that ensure enough skilled labour is available for OWS in the future (Action 5). The aim of the action on one hand is to identify the core skill sets and formal qualifications needed to work effectively and safely in various OWS tasks, and design a portfolio of training programs to deliver the necessary skills and qualifications both within secondary education and as life-long learning. On the other the aim is to establish a ‘skills gap’ for the need of training and education in quantitative terms to enable OWS industry and educators to see what concrete action is needed.

To summarise, Fig. 6 illustrates the sequence of the proposed actions and their relations to the goals of the industry. Each work stream contributes to one or more sub goals set for the JAP, which together take OWS and offshore wind closer to the overall target of lowering LCoE 40% by 2020. The dependencies of the action discussed above are not shown in the figure for the purposes of clarity. The communication work stream creates a basis for arguing the importance getting the support for OWS. It also serves to build the collaborative relations and consortia needed for effective goal-driven RDI that in itself contributes to the goal of establishing RDI to develop cost-reducing innovations. The third work stream builds on the previous ones and contributes both to technical standardisation and harmonisation of skills and qualifications. Last but not least, the fourth work stream directly contributes to skilled and qualified work force for OWS.

Concerning the implementation of the actions ad JAP as a whole, the ‘owner’ of the JAP is in a sense the OWS industry, who has an interest to drive the JAP forwards. However, during the runtime of the project, the ECOWindS consortium represents the industry in terms of managing the JAP process It is proposed that a post-ECOWindS consortium that comprises industry associations, OWS enterprises and operators who together have the most direct interest in the matter is to be formed to continue driving the JAP actions and keeping the plan up to date.

In terms of the individual actions, it is proposed that each action is implemented by a specialised consortium of stakeholders with the most interest to drive the action forward. There are two benefits. First, it ensures that the best capabilities and relevant interests are represented in implementation of each action. Second, the responsibility is distributed outside the (post-) ECOWindS consortium to enable more effective parallel implementation of the actions.

As for the level of implementation, the actions are primarily to be implemented on the cross regional or international (European) level following the logic of the JAP. Despite that, some of them have repercussion on regional and organisational level. To take an example, the RDI programme (A3) includes sub-actions that can be completed by one organisation if so desired. Also the skills action (A5) can be partially implemented by individual organisations who wish to offer training and education for OWS. However these two also include trans-national components that aim to bridge the strengths of various actors to create international impact.

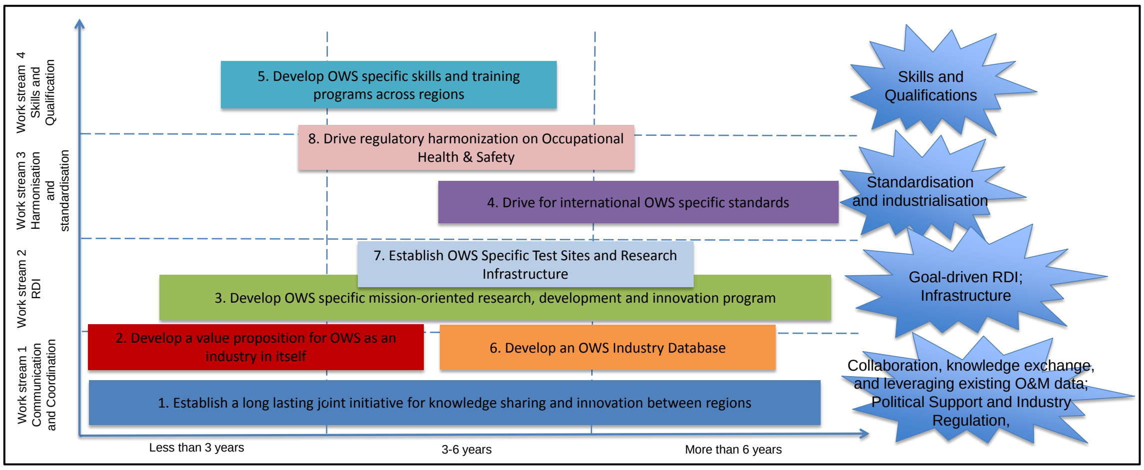


*Figure 6. Joint Action Plan timeline with work streams.*

## Conclusion

A key to successful implementation of the JAP and the actions within it is that they aim to bridge national interests together, to enable cross border collaboration starting particularly around the North Sea and extending overseas as the industry grows. The rationale is to leverage the best capabilities and to enable mutual learning across European regions. Further, international scope of the projects enables attracting a wider base of funding, as well as a greater impact. To summarise the key messages of the JAP and to pave the way to a successful future of OWS, we round up the discussion by reinforcing some of the key points;

*Rally around the vision for stronger offshore wind services* – ensuring OWS becomes a recognised industry in itself in which industrialisation and purposeful R&D lead to standardisation, interoperability between components, and efficient installation and O&M services.

*Leverage the close ties and proximity of actors around the North Sea for purposeful RDI* – ensuring industry and research organisations collaborate to benefit from the sharing of complementary capabilities and expertise, and facilitating more candid feedback within the whole offshore wind ecosystem.

*Pay attention to building the actions and follow through to implementation* – the ECOWindS consortium and the JAP are laying the foundations of each action and facilitating appropriate consortia for their implementation. Inter-regional partners must be involved to leverage the best capabilities to enable mutual learning across European regions. Further, international scope of the projects enables attracting a wider base of funding, as well as an impact.

## References

Arwas, P., Charlesworth, D., Clark, D., Clay, R., Craft, G., Donaldson, I., … Wiles, F. (2012). *Offshore Wind Cost Reduction: Pathways Study* (p. 88). London, UK.

Azau, S., & Casey, Z. (Eds.). (2011). *Wind in our Sails: The coming of Europe's offshore wind energy industry*. Brussels, BE: European Wind Energy Association.

Corbetta, G. (2014). *The European offshore wind industry - key trends and statistics 2013*. Brussels, BE.

ECOWindS: The European Clusters for Offshore Wind Servicing. (2013). Retrieved March 09, 2015, from http://ecowinds.eu/

EERA. (2014). EERA Joint Programme Wind Energy. Retrieved October 21, 2014, from http://www.eera-set.eu/eera-joint-programmes-jps/15-eera-joint-programmes/wind-energy/

European Commission. A European Strategic Energy Technology Plan (SET-Plan) - “Towards a low carbon future” (2007). European Union.

Feser, E. J., & Bergman, E. M. (2000). National Industry Cluster Templates: A Framework for Applied Regional Cluster Analysis. *Regional Studies*, *34*(1), 1–19. doi:10.1080/00343400050005844

Foray, D., Goddard, J., Beldarrain, X. G., Landabaso, M., McCann, P., Morgan, K., … Ortega-Argilés, R. (2012). *Guide to Research and Innovation Strategies for Smart Specialization (RIS3)* (p. 114).

Green, R., & Vasilakos, N. (2011). The economics of offshore wind. *Energy Policy*, *39*(2), 496–502. doi:10.1016/j.enpol.2010.10.011

IEC. (2014). Technical Committee 88 “Wind Turbines” Dashboard. Retrieved November 06, 2014, from http://www.iec.ch/dyn/www/f?p=103:22:0::::FSP_ORG_ID,FSP_LANG_ID:1282,25

IRENA Secretariat. (2012). *Wind Power* (No. Volume 1: Power Sectors, Issue 5/5). Abu Dhabi, UAE.

Megavind. (2013). *Denmark – Supplier of Competitive Offshore Wind Solutions: Roadmap for Megavind’s Strategy for Offshore Wind Research, Development, and Demonstration* (p. 30). Copenhagen, DK.

Piirainen, K. A. (2014). The GRIP method for collaborative roadmapping workshops. In *5th International Conference on Future-Oriented Technology Analysis (FTA) - Engage today to shape tomorrow*. Brussels, BE: European Commission.

Piirainen, K. A., Tanner, A. N., Alkærsig, L., & Andersen, P. D. (2014). Smart Specialization and Capabilities for Offshore Wind Services around the North Sea. In *Proceedings of the XXV ISPIM Conference*. Dublin, IE: ISPIM.

Porter, M. E. (2000). Location, Competition, and Economic Development: Local Clusters in a Global Economy. *Economic Development Quarterly*, *14*(1), 15–34. doi:10.1177/089124240001400105

Stolpe, M., Buhl, T., Sumer, B. M., Kiil, S., Holbøll, J., & Piirainen, K. A. (2014). Offshore wind energy development. In H. H. Larsen & L. S. Petersen (Eds.), *Wind energy — drivers and barriers for higher shares of wind in the global power generation mix* (pp. 43–51). Kongens Lyngby, DK: DTU National Laboratory for Sustainable Energy.

TPWind. (2014). *Strategic Research Agenda / Market Deployment Strategy (SRA/MDS)* (p. 79).